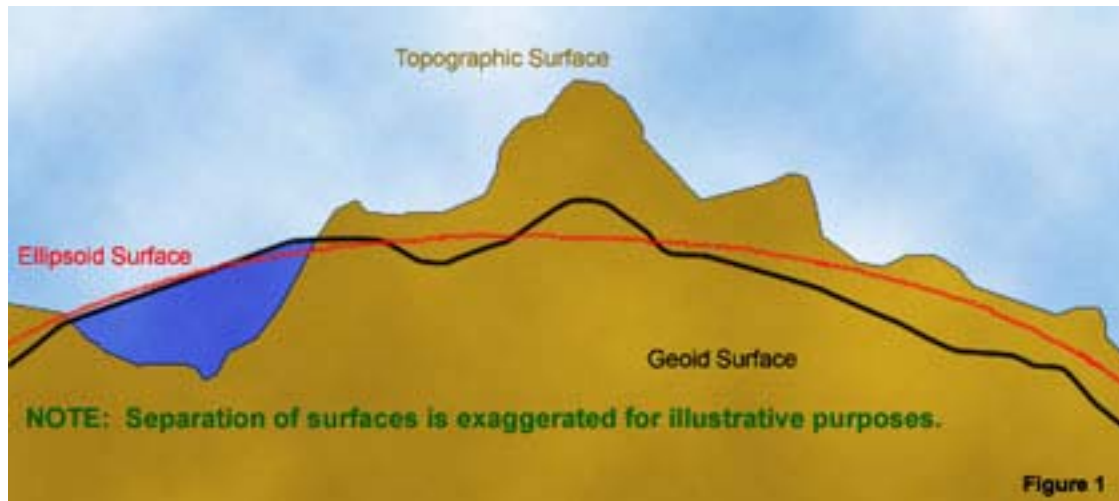


Basic Geodesy

Issue 6

Late May 2005



Geoids and Vertical Datums

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When discussing the subject of vertical datums, we must consider the three surfaces illustrated in Figure 1. The ground surface is what we are standing on.

The mathematical model we use for the shape of the Earth is the ellipsoid surface. This surface is the reference for HaE, or Height above the Ellipsoid.

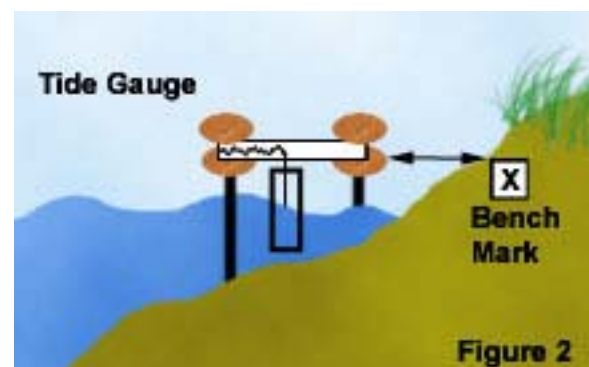
The geoid is the surface along which gravity potential is equal and to which the direction of gravity is always perpendicular (paraphrased from *Geodesy for the Layman*, February 1968, Capt. R. K. Burkard).

Heights referenced to the geoid are termed orthometric heights.

Most of the time, when we refer to a geoid, we are referring to one that approximates tide-free mean sea level. If the composition of the earth and the water bodies were homogenous, the geoid would be a smooth surface. However, the gravitational pull of the earth is stronger under areas that have higher concentrations of iron and other dense minerals. Therefore, the geoid is an irregular surface and the areas of separation between the geoid and ellipsoid are

referred to as geodetic undulations or geoid separations.

In order to create a vertical datum, measurements are made over a long period of time (the attraction of the sun and moon vary over an 18 year period) and benchmarks are established (See Figure 2). The ocean surface is affected by the Earth's gravity, the spin of the earth, the gravitational pull of the sun and moon and differences in temperature, pressure, and salinity. Most contour lines on topographic products are based on Mean Sea Level (MSL) or a similar vertical datum such as North American Geodetic Vertical Datum 1929 (NGVD 29).



Gravity

The next article will discuss gravity and its effects on surveying.